

## PATENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:

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GOUDREAU GAGE DUBUC  
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397-2602NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL PRELIMINARY  
REPORT ON PATENTABILITY  
(PCT Rule 71.1)Date of mailing  
(day/month/year)

01.09.2005

Applicant's or agent's file reference  
MS/3837.45

## IMPORTANT NOTIFICATION

International application No.  
PCT/CA2004/000514International filing date (day/month/year)  
05.04.2004Priority date (day/month/year)  
04.04.2003Applicant  
PHOENIX HAUTE TECHNOLOGIE INC.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary report on patentability and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary report on patentability. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

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# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>MS/13837.45</b>	<b>FOR FURTHER ACTION</b>		See Form PCT/PEA/16
International application No. <b>PCT/CA2004/000514</b>	International filing date (day/month/year) <b>05.04.2004</b>	Priority date (day/month/year) <b>04.04.2003</b>	
International Patent Classification (IPC) or national classification and IPC <b>C10J318, C10J346, C10J367</b>			
Applicant <b>PHOENIX HAUTE TECHNOLOGIE INC.</b>			
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 7 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p style="margin-left: 20px;">a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau a total of 5 sheets, as follows:</p> <p style="margin-left: 40px;"><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p style="margin-left: 40px;"><input checked="" type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in Item 4 of Box No. I and the Supplemental Box.</p> <p style="margin-left: 20px;">b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>			
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input checked="" type="checkbox"/> Box No. VIII Certain observations on the international application</p>			
Date of submission of the demand  <b>03.02.2005</b>	Date of completion of this report  <b>01.09.2005</b>		
Name and mailing address of the International preliminary examining authority:   European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 661 apo nl Fax: +31 70 340 - 3016	Authorized Officer  <b>Lapeyrere, J</b>  Telephone No. +31 70 340-2333  		

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.  
PCT/CA2004/000514

## Box No. 1 Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
  - ☐ This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:
    - ☐ international search (under Rules 12.3 and 23.1(b))
    - ☐ publication of the international application (under Rule 12.4)
    - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements**\* of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

### Description, Pages

1-19 as originally filed

### Claims, Numbers

1-25 filed with telefax on 03.02.2005

### Drawings, Sheets

1/3-3/3 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

4. ☒ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☒ the claims, Nos. 1-19
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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**1. Statement**

Novelty (N)	Yes: Claims	20-25
	No: Claims	1
Inventive step (IS)	Yes: Claims	20-25
	No: Claims	1
Industrial applicability (IA)	Yes: Claims	1-25
	No: Claims	

**2. Citations and explanations (Rule 70.7):****see separate sheet**

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**Box No. VIII Certain observations on the international application**

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The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

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**PCT/CA2004/000514****Re Item I****Basis of the report**

1. Amendment brought in claim 1 by the applicant has been examined and is considered as going beyond the scope the application as filed for the following reasons.  
Applicant, in his letter of 03.02.2005, says that he has introduced original claim 13 in original claim 1 in response to the novelty objection raised by the examiner. But in the amended claim 1, the feature "a plasma torch" has been omitted while it is clearly present in original claim 13. Moreover in the description, the second gasification stage is always described as comprising a plasma torch (see page 7, lines 10 to 12, page 8, lines 9 to 13, page 9, lines 17 and 18, and page 13, line 17). Therefore omitting this feature is broadening the scope claim 1 beyond what is disclosed in the original application.
2. Amendments brought in claim 20 by the applicant have been examined and are considered as acceptable.
3. Therefore examination of present preliminary report has been carried out on original claims 1 to 19. and amended claims 20 to 25.

**Re Item V****Reasoned statement with regard to novelty, inventive step or Industrial applicability; citations and explanations supporting such statement**

The following document is referred to in this communication:

D1 : WO 02/081909

D2 : US 6 127 645

**INDEPENDENT CLAIM 1**

4. The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 is not new in the sense of Article 33(2) PCT.  
Document D1 discloses (the references in parenthesis applying to this document):  
a two-stage plasma process for converting waste having organic and inorganic components into fuel gas, which comprises:  
(a) in the first stage, vitrifying or melting the inorganic components of the waste and partially gasifying the organic components; (see page 5, line 26 to 31) and  
(b) in the second stage, completing the gasification of the organic components so as to convert them into fuel gas. (see page 6, line 36 to page 7, line 20)

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**PCT/CA2004/000514****INDEPENDENT CLAIM 20**

5. The document D2 is regarded as being the closest prior art to the subject-matter of claim 20, and shows (the references in parentheses applying to this document):

apparatus for converting waste having organic and inorganic components into fuel gas, which includes;

(a) a primary gasifier comprising a refractory lined, enclosed plasma arc furnace provided with at least one graphite electrode; (column 7, lines 20 to 26) at least one inlet for feeding waste into the furnace; (column 6, lines 55 to 57) means for feeding air, oxygen and / or steam in metered amounts into the furnace; (column 7, lines 4 to 8) and a gas take off port for primary synthesis gas produced in said primary gasifier; (column 6, lines 16 to 18)

The subject-matter of claim 20 differs from this known apparatus in that

(b) a secondary gasifier to which the primary synthesis gas is fed, said secondary gasifier being equipped with a plasma-torch fired eductor;  
means for supplying metered amounts of air, oxygen and/or steam into the eductor;  
said eductor leading to an insulated chamber;  
and an outlet being provided in said chamber for the fuel gas resulting from the operation.

6. The subject-matter of claim 20 is therefore new (Article 33(2) PCT).  
The problem to be solved by the present invention may be regarded as providing means to improve quality of the syngas.
7. The solution to this problem proposed in claim 20 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:  
Document D1 discloses an apparatus for gasification of carbonaceous wastes which comprises two "catalytic ionic-impact chambers". The second gasification chamber is connected to the first one to receive and treat the syngas in the first one.  
Nevertheless document D1 does not disclose an apparatus with a "plasma-torch fired eductor". Therefore should the man skilled in the art combine the teaching of document D1 with the one of document D2, he would not obtain the object of current application.
8. Claims 21 to 25 are dependent on claim 20 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

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**Re Item VI**

**Certain documents cited**

**Certain published documents**

Application No Patent No	Publication date (day/month/year)	Filing date (day/month/year)	Priority date (valid claim) (day/month/year)
WO03/095072	20 November 2003	6 May 2003	8 May 2002

**Re Item VIII**

**Certain observations on the international application**

9. As explained below, some of the features in the apparatus claim 20 relate to a method of using the apparatus rather than clearly defining the apparatus in terms of its technical features. The intended limitations are therefore not clear from this claim, contrary to the requirements of Article 6 PCT.
  - said primary gasifier being adapted to maintain layers of molten metal and molten slag at the bottom of the furnace and on top of the molten slag a layer of partially treated waste on top of which fresh waste is fed.
10. Claim 20 do not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined. The claim attempt to define the subject-matter in terms of the result to be achieved, which merely amounts to a statement of the underlying problem, without providing the technical features necessary for achieving this result.
  - and said at least one graphite electrode being adapted to generate a plasma arc to the molten slag present in the furnace during the operation.
  - adapted to expose the primary synthesis gas entering from the primary gasifier to a high temperature such as to transform any soot present in said primary gas into CO and to convert any complex organic molecule to simpler molecules CO, CO and H<sub>2</sub>;
11. The term "essentially" used in claim 20 is vague and unclear and leaves the reader in

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doubt as to the meaning of the technical feature to which it refers, thereby rendering the definition of the subject-matter of said claim unclear, (Article 6 PCT)

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## CLAIMS

(87)

1. A two-stage plasma process for converting waste having organic and inorganic components into fuel gas, which comprises:
- 5 (a) in the first stage, vitrifying or melting the inorganic components of the waste and partially gasifying the organic components; and
- (b) in the second stage, completing the gasification of the organic components so that gas from the first stage of the process entering the secondary gasifier is exposed to a high temperature such as to transform essentially all soot present in the gas to CO and to convert essentially all
- 10 complex organic molecules to simpler molecules CO, CO<sub>2</sub> and H<sub>2</sub>.
2. A process according to claim 1, in which a dust separation and removal step is provided between the two stages of the process.
3. A process according to claims 1 or 2, in which the fuel gas produced in the second stage is quenched and cleaned to make it suitable for use in a gas engine
- 15 or turbine for production of electricity or in a gas burner for production of steam or in chemical synthesis reactions.
4. A process according to claims 1, 2 or 3, in which the first stage is carried out in a plasma arc furnace.
5. A process according to any one of claims 1 to 4, in which the second stage is
- 20 carried out in a secondary gasifier using a plasma torch with addition of metered amounts of oxygen, air and/or steam.
6. A process according to claim 4, in which the plasma arc furnace is a refractory lined, enclosed furnace provided with at least one direct current graphite electrode adapted to generate a plasma arc to a bath of liquid inorganic material originating

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from the waste itself and located at the bottom of the furnace.

7. A process according to claim 6, in which said liquid inorganic material comprises a slag layer which is maintained at a temperature of at least 1500°C.

8. A process according to claim 7, in which said liquid inorganic material further  
5 comprises a metal layer also maintained at a temperature of at least 1500°C and located under the slag layer.

9. A process according to claims 6, 7 or 8, in which the waste is introduced into the furnace on top of the liquid inorganic material and the organic component in the waste reacts with air, oxygen and/or steam supplied to the furnace in a predetermined  
10 amount adapted to achieve gasification of organic material in the waste into a primary synthesis gas containing CO, H<sub>2</sub>, CO<sub>2</sub> and N<sub>2</sub> if the waste contains nitrogen or if air is added to the furnace, and also containing some soot and complex organic molecules.

10. A process according to claim 9, in which the organic material in the waste is so reacted as to form a layer of partially treated waste on top of the slag layer and  
15 fresh waste is introduced into the furnace on top of said partially treated waste layer which is maintained at a temperature of between 700 and 800°C and constitutes a cold top for the fresh waste added to the furnace.

11. A process according to claims 9 or 10, in which the primary synthesis gas is subjected to dust separation and removal in which dust particles larger than a  
20 predetermined size are separated and removed.

12. A process according to claim 11, in which the removed dust particles are recycled to the furnace.

13. A process according to claim 5, in which the secondary gasifier is equipped with a plasma torch fired eductor for exposing the gas from the first stage of the

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process entering the secondary gasifier to a high temperature.

14. A process according to claim 13, in which the high temperature to which gas from the first stage is exposed in the secondary gasifier is between 900°C and 1300°C.
- 5 15. A process according to claim 14, in which the high temperature is achieved mainly by partial oxidation of the gas from the first stage by injection of predetermined amounts of air, oxygen and/or steam to the eductor, and the plasma torch provides only a small fraction of the energy required for maintaining said high temperature.
- 10 16. A process according to claims 13, 14 or 15, in which the fuel gas exiting the secondary gasifier is cooled down very rapidly to a temperature below 100°C so as to freeze the thermodynamic equilibrium of the fuel gas and avoid production of secondary pollutants.
17. A process according to claim 16, in which after cooling, the fuel gas is
- 15 subjected to a final cleaning operation to remove any remaining contaminants.
18. A process according to any one of the preceding claims 1 to 16, in which the process is carried out under a negative pressure to preclude exit of toxic fumes or of flammable materials from any unit operations.
19. A process according to any one of the preceding claims 1 to 18, in which an
- 20 oxygen starved environment is used in the process to preclude dioxin formation.
20. Apparatus for converting waste having organic and inorganic components into fuel gas, which includes:
- (a) a primary gasifier comprising a refractory lined, enclosed plasma arc furnace provided with at least one graphite electrode; at least one inlet

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for feeding waste into the furnace; means for feeding air, oxygen and/or steam in metered amounts into the furnace; and a gas take off port for primary synthesis gas produced in said primary gasifier; said primary gasifier being adapted to maintain layers of molten metal and molten slag at the bottom of the furnace and on top of the molten slag a layer of partially treated waste on top of which fresh waste is fed; and said at least one graphite electrode being adapted to generate a plasma arc to the molten slag present in the furnace during the operation; and

(b) a secondary gasifier to which the primary synthesis gas is fed, said secondary gasifier being equipped with a plasma-torch fired eductor adapted to expose the primary synthesis gas entering from the primary gasifier to a high temperature such as to transform essentially any soot present in said primary gas into CO and to convert essentially any complex organic molecule to simpler molecules CO, CO<sub>2</sub> and H<sub>2</sub>; means for supplying metered amounts of air, oxygen and/or steam into the eductor; said eductor leading to an insulated chamber; and an outlet being provided in said chamber for the fuel gas resulting from the operation.

21. Apparatus according to claim 20, in which in the primary gasifier two graphite electrodes are used creating an arc between one electrode and the slag during the operation, and creating a second arc from the slag to the second electrode.

22. Apparatus according to claims 20 or 21, in which the eductor provided in the secondary gasifier is made of a high heat metal alloy or is refractory lined or water cooled, and is equipped with the plasma torch at its inlet.

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23. Apparatus according to claims 20, 21 or 22, further comprising a dust separator between the primary gasifier and the secondary gasifier.
24. Apparatus according to any one of claims 20 to 23, further comprising a gas quenching and gas cleaning means following the secondary gasifier.
- 5 25. Apparatus according to any one of claims 20 to 24, further comprising an induced draft fan adapted to operate the apparatus under a negative pressure.